

# Elasticity, Consumer Surplus, and Producer Surplus

Chapter 6 is basically a continuation of Chapter 3. In the earlier part of the book, you needed only an elementary knowledge of supply and demand. Now the economic principles, problems, and policies to be studied require a more detailed discussion of supply and demand.

The concept of **price elasticity of demand**, to which the major portion of Chapter 6 is devoted, is of great importance for studying the material found in the remainder of the text. You must understand (1) what price elasticity measures; (2) how the price-elasticity formula is applied to measure the price elasticity of demand; (3) the difference between price elastic, price inelastic, and unit elasticity; (4) how total revenue varies by the type of price elasticity of demand; (5) the meaning of perfect price elasticity and of perfect price inelasticity of demand; (6) the four major determinants of price elasticity of demand; and (7) the practical application of the concept to many economic issues.

When you have become thoroughly acquainted with the concept of price elasticity of demand, you will find that you have very little trouble understanding the **price elasticity of supply**. The transition requires no more than the substitution of the words "quantity supplied" for the words "quantity demanded." You should concentrate your attention on the meaning of price elasticity of supply and how it is affected by time. Several examples are provided to show how it affects the prices of many products.

The chapter also introduces you to two other elasticity concepts. The **cross elasticity of demand** measures the sensitivity of a change in the quantity demanded for one product due to a change in the price of another product. This concept is especially important in identifying substitute, complementary, or independent goods. The **income elasticity of demand** assesses the change in the quantity demanded of a product resulting from a change in consumer incomes. It is useful for categorizing goods as superior, normal, or inferior.

Supply and demand analysis is used to enhance your understanding of **economic efficiency** in the fourth section of the chapter. This extension requires an explanation of the concepts of **consumer surplus** and **producer surplus**. Consumer surplus is the difference between the maximum price consumers are willing to pay for a product and the actual price. Producer surplus is the difference between the minimum price producers are willing to accept for a product and the actual price. The chapter also revisits the concept of **allocative efficiency** and explains that it is achieved when the combination of consumer and producer surplus is at a maximum.

## ■ CHECKLIST

When you have studied this chapter you should be able to

- ☐ Define price elasticity of demand and compute its coefficient when given the demand data.
- ☐ State the midpoint formula for price elasticity of demand and explain how it refines the original formula for price elasticity.
- ☐ State two reasons why the formula for price elasticity of demand uses percentages rather than absolute amounts in measuring consumer responsiveness.
- ☐ Explain the meaning of elastic, inelastic, and unit elasticity as they relate to demand.
- ☐ Define and illustrate graphically the concepts of perfectly elastic demand and perfectly inelastic demand.
- ☐ Apply the total-revenue test to determine whether demand is elastic, inelastic, or unit elastic.
- ☐ Describe the relationship between price elasticity of demand and the price range for most demand curves.
- ☐ Explain why the slope of the demand curve is not a sound basis for judging price elasticity.
- ☐ Illustrate graphically the relationship between price elasticity of demand and total revenue.
- ☐ List the four major determinants of the price elasticity of demand, and explain how each determinant affects price elasticity.
- ☐ Describe several applications of the concept of price elasticity of demand.
- ☐ Define the price elasticity of supply and compute its coefficient when given the relevant data.
- ☐ Explain the effect of time (short run and long run) on price elasticity of supply.
- ☐ Describe several applications of price elasticity of supply.
- ☐ Define cross elasticity of demand and compute its coefficient when given relevant data.
- ☐ Use the cross elasticity of demand to categorize substitute goods, complementary goods, and independent goods.
- ☐ Give applications of cross elasticity of demand.
- ☐ Define income elasticity of demand and compute its coefficient when given relevant data.
- ☐ Use the income elasticity of demand to categorize goods as normal or inferior.
- ☐ Provide some insights using the concept of income elasticity.
- ☐ Define consumer surplus and give a graphical example.
- ☐ Define producer surplus and give a graphical example.

- ☐ Use consumer surplus and producer surplus to explain how allocative efficiency is achieved in a competitive market.
- ☐ List the three conditions for achieving allocative efficiency at a quantity level in a competitive market.
- ☐ Use a supply and demand graph to illustrate efficiency losses when the quantity is greater or less than its equilibrium in a competitive market.
- ☐ Use the concept of elasticity of demand to explain why different consumers pay different prices (Last Word).

## ■ CHAPTER OUTLINE

**1. Price elasticity of demand** is a measure of the responsiveness or sensitivity of quantity demanded to changes in the price of a product. When quantity demanded is relatively responsive to a price change, demand is said to be *elastic*. When quantity demanded is relatively unresponsive to a price change, demand is said to be *inelastic*.

a. The exact degree of elasticity can be measured by using a formula to compute the elasticity coefficient.

(1) The changes in quantity demanded and in price are comparisons of consumer responsiveness to price changes of different products.

(2) A **midpoint formula** calculates price elasticity across a price and quantity range to overcome the problem of selecting the reference points for price and quantity. In this formula, the average of the two quantities and the average of the two prices are used as reference points.

(3) Because price and quantity demanded are inversely related, the price elasticity of demand coefficient is a negative number, but economists ignore the minus sign in front of the coefficient and focus their attention on its absolute value.

b. The coefficient of price elasticity has several interpretations.

(1) **Elastic demand** occurs when the percentage change in quantity demanded is greater than the percentage change in price. The elasticity coefficient is greater than 1.

(2) **Inelastic demand** occurs when the percentage change in quantity demanded is less than the percentage change in price. The elasticity coefficient is less than 1.

(3) **Unit elasticity** occurs when the percentage change in quantity demanded is equal to the percentage change in price. The elasticity coefficient is equal to 1.

(4) **Perfectly inelastic demand** means that a change in price results in no change in quantity demanded of a product, whereas **perfectly elastic demand** means that a small change in price causes buyers to purchase all they desire of a product.

c. **Total revenue (TR)** changes when price changes. The **total-revenue test** shows that when demand is:

(1) *elastic*, a decrease in price will increase total revenue and an increase in price will decrease total revenue.

(2) *inelastic*, a decrease in price will decrease total revenue and an increase in price will increase total revenue.

(3) *unit elastic*, an increase or decrease in price will not affect total revenue.

d. Note several points about the graph of a linear demand curve and price elasticity of demand.

(1) It is not the same at all prices. Demand is typically elastic at higher prices and inelastic at lower prices.

(2) It cannot be judged from the slope of the demand curve.

e. The relationship between price elasticity of demand and total revenue can be shown by graphing the demand curve and the total-revenue curve, one above the other. In this case, the horizontal axis for each graph uses the same quantity scale. The vertical axis for demand represents price. The vertical axis for the total-revenue graph measures total revenue.

(1) When demand is price elastic, as price declines and quantity increases along the demand curve, total revenue increases in the total-revenue graph.

(2) Conversely, when demand is price inelastic, as price declines and quantity increases along the demand curve, total revenue decreases.

(3) When demand is unit elastic, as price and quantity change along the demand curve, total revenue remains the same.

f. The price elasticity of demand for a product depends on four determinants.

(1) The number of good substitutes for the product. The more substitute goods that are available for a product, the greater the price elasticity of demand for the product.

(2) Its relative importance in the consumer's budget. The higher the price of product relative to consumers' incomes, the greater the price elasticity of demand.

(3) Whether it is a necessity or a luxury. Luxuries typically have a greater price elasticity of demand than necessities.

(4) The period of time under consideration. The longer the time period, the greater the elasticity of demand for a product.

g. Price elasticity of demand has practical applications to public policy and business decisions. The concept is relevant to bumper crops in agriculture, excise taxes, and the decriminalization of illegal drugs.

**2. Price elasticity of supply** is a measure of the sensitivity of quantity supplied to changes in the price of a product. Both the general formula and the midpoint formula for price elasticity of supply are similar to those for price elasticity of demand, but "quantity supplied" replaces "quantity demanded." This means that the price elasticity of supply is the percentage change in quantity supplied of a product divided by its percentage change in the price of the product. There is a midpoint formula that is an average of quantities and prices and is used for calculating the

elasticity of supply across quantity or price ranges. The price elasticity of supply depends primarily on the amount of time sellers have to adjust to a price change. The easier and faster suppliers can respond to changes in price, the greater the price elasticity of supply.

a. In the **market period**, there is too little time for producers to change output in response to a change in price. As a consequence supply is perfectly inelastic. Graphically, this means that the supply curve is vertical at that market level of output.

b. In the **short run**, producers have less flexibility to change output in response to a change in price because they have fixed inputs that they cannot change. They have only a limited control over the range in which they can vary their output. As a consequence, supply is *price inelastic* in the short run.

c. In the **long run**, producers can make adjustments to all inputs to vary production. As a consequence, supply is *price elastic* in the long run. There is no total-revenue test for price elasticity of supply because price and total revenue move in the same direction regardless of the degree of price elasticity of supply.

d. Price elasticity of supply has many practical applications for explaining price volatility. The concept is relevant to the pricing of antiques and gold, for which the supply is perfectly inelastic.

3. Two other elasticity concepts are important.

a. The **cross elasticity of demand** measures the degree to which the quantity demanded of one product is affected by a change in the price of another product. Cross elasticities of demand are:

- (1) positive for goods that are substitutes;
- (2) negative for goods that are complements; and
- (3) zero or near zero for goods that are unrelated or independent.

b. The **income elasticity of demand** measures the effect of a change in income on the quantity demanded of a product. Income elasticities of demand are:

- (1) positive for normal or superior goods, which means that more of them are demanded as income rises; and
- (2) negative for inferior goods, which means that less of them are demanded as income rises.

4. In market transactions, consumers can obtain a beneficial surplus and so can producers.

a. **Consumer surplus** is the difference between the maximum price consumers are willing to pay for a product and the actual (equilibrium) price paid. Graphically, it is the triangular area bounded by the portion of the vertical axis between the equilibrium price and the demand curve intersection, the portion of the demand curve above the equilibrium price, and the horizontal line at the equilibrium price from the vertical axis to the demand curve. Price and consumer surplus are inversely (negatively) related: Higher prices reduce it and lower prices increase it.

b. **Producer surplus** is the difference between the minimum price producers are willing to accept for a

product and the actual (equilibrium) price received. Graphically, it is the triangular area bounded by the portion of the vertical axis between the equilibrium price and the supply curve intersection, the portion of the supply curve below the equilibrium price, and the horizontal line at the equilibrium price from the vertical axis to the supply curve. Price and producer surplus are directly (positively) related: Higher prices increase it and lower prices decrease it.

c. The equilibrium quantity shown by the intersection of demand and supply curves reflects *economic efficiency*.

(1) **Productive efficiency** is achieved because production costs are minimized at each quantity level of output.

(2) **Allocative efficiency** is achieved at the equilibrium quantity of output because three conditions are satisfied: Marginal benefit equals marginal cost; maximum willingness to pay equals minimum acceptable price; and the combination of the consumer and producer surplus is at a maximum.

d. If quantity is less than or greater than the equilibrium quantity or most efficient level, there are **efficiency losses** (or **deadweight losses**) to buyers and sellers. The efficiency losses reduce the maximum possible size of the combined consumer and producer surplus.

5. (Last Word). There are many examples of dual or multiple pricing of products. The main reason for the differences is differences in the price elasticity of demand among groups. Business travelers have a more inelastic demand for travel than leisure travelers and thus can be charged more for an airline ticket. Prices for children are often lower than prices for adults for the same service (for example, movie tickets or restaurant meals) because children have more elastic demand for the service. Low-income groups have a more elastic demand for higher education than high-income groups, so high-income groups are charged the full tuition price and lower-income groups get more financial aid to offset the tuition price.

#### ■ HINTS AND TIPS

1. This chapter is an extension of the material presented in Chapter 3. Be sure you thoroughly read and study Chapter 3 again before you read and do the self-test exercises for this chapter.

2. You should **not judge** the price elasticity of demand based on the slope of the demand curve unless it is horizontal (*perfectly elastic*) or vertical (*perfectly inelastic*). Remember that elasticity varies from elastic to inelastic along a downsloping, linear demand curve. The price elasticity equals 1 at the midpoint of a downsloping linear demand curve.

3. Master the **total-revenue test** for assessing the price elasticity of demand (review Table 6.2). For many

problems, the total-revenue test is easier to use than the midpoint formula for identifying the type of elasticity (elastic, inelastic, unit), and the test has many practical applications.

4. Do not just memorize the elasticity formulas in this chapter. Instead, work on understanding what they mean and how they are used for economic decisions. The elasticity formulas simply measure the *responsiveness* of a percentage change in *quantity* to a percentage change in some other characteristic (price or income). The elasticity formulas each have a similar structure: A percentage change in some type of *quantity* (demanded, supplied) is divided by a percentage change in the other variable. The price elasticity of demand measures the responsiveness of a percentage change in *quantity demanded* for a product to a percentage change in its *price*. The cross elasticity of demand measures the percentage change in the *quantity demanded of product X* to a percentage change in the *price of product Y*. The income elasticity of demand is the percentage change in *quantity demanded* for a product to a percentage change in *income*. The price elasticity of supply is the percentage change in the *quantity supplied* of a product to a percentage change in its price.

5. The term "surplus" in this chapter should not be confused with its previous use related to pre-set prices and price floors. What the consumer surplus refers to is the extra utility or satisfaction that consumers get when they do not have to pay the price they were willing to pay and pay the lower equilibrium price. The producer surplus arises when producers receive an equilibrium price that is above the minimum price that they consider acceptable to selling the product.

#### IMPORTANT TERMS

price elasticity of demand	market period
midpoint formula	short run
elastic demand	long run
inelastic demand	cross elasticity of demand
unit elasticity	income elasticity of demand
perfectly inelastic demand	consumer surplus
perfectly elastic demand	producer surplus
total revenue	efficiency losses
total-revenue test	(or deadweight losses)
price elasticity of supply	

#### SELF-TEST

#### FILL-IN QUESTIONS

1. If a relatively large change in price results in a relatively small change in quantity demanded, demand is (elastic, inelastic) \_\_\_\_\_. If a relatively small change in price results in a relatively large change in quantity demanded, demand is (elastic, inelastic) \_\_\_\_\_.

2. The midpoint formula for the price elasticity of demand uses the (total, average) \_\_\_\_\_ of the two quantities as a reference point in calculating the percentage change in quantity and the (total, average) \_\_\_\_\_ of the two prices as a reference point in calculating the percentage change in price.

3. The price elasticity formula is based on (absolute amounts, percentages) \_\_\_\_\_ because it avoids the problems caused by the arbitrary choice of units and permits meaningful comparisons of consumer (responsiveness, incomes) \_\_\_\_\_ to changes in the prices of different products.

4. If a change in price causes no change in quantity demanded, demand is perfectly (elastic, inelastic) \_\_\_\_\_ and the demand curve is (horizontal, vertical) \_\_\_\_\_. If an extremely small change in price causes an extremely large change in quantity demanded, demand is perfectly (elastic, inelastic) \_\_\_\_\_ and the demand curve is (horizontal, vertical) \_\_\_\_\_.

5. Two characteristics of the price elasticity of a linear demand curve are that elasticity (is constant, varies) \_\_\_\_\_ over the different price ranges, and that the slope is (a sound, an unsound) \_\_\_\_\_ basis for judging its elasticity.

6. Assume the price of a product declines.

a. When demand is inelastic; the loss of revenue due to the lower price is (less, greater) \_\_\_\_\_ than the gain in revenue due to the greater quantity demanded.

b. When demand is elastic; the loss of revenue due to the lower price is (less, greater) \_\_\_\_\_ than the gain in revenue due to the greater quantity demanded.

c. When demand is unit elastic; the loss of revenue due to the lower price (exceeds, is equal to) \_\_\_\_\_ the gain in revenue due to the greater quantity demanded.

7. Complete the following summary table.

If demand is	The elasticity coefficient is	If price rises, total revenue will	If price falls, total revenue will
Elastic	_____	_____	_____
Inelastic	_____	_____	_____
Unit elastic	_____	_____	_____

8. What are the four most important determinants of the price elasticity of demand?

- \_\_\_\_\_
- \_\_\_\_\_

- c. \_\_\_\_\_  
d. \_\_\_\_\_
9. The demand for most farm products is highly (elastic, inelastic) \_\_\_\_\_. which means that large crop yields will most likely (increase, decrease) \_\_\_\_\_ the total revenue of farmers. Governments often tax products such as liquor, gasoline, and cigarettes because the price elasticity of the demand is (elastic, inelastic) \_\_\_\_\_. A higher tax on such products will (increase, decrease) \_\_\_\_\_ tax revenue.
10. The price elasticity of supply measures the percentage change in (price, quantity supplied) \_\_\_\_\_ divided by the percentage change in \_\_\_\_\_. The most important factor affecting the price elasticity of supply is (revenue, time) \_\_\_\_\_. It is easier to shift resources to alternative uses when there is (more, less) \_\_\_\_\_ time.
11. In the immediate market period, the price elasticity of supply will be perfectly (elastic, inelastic) \_\_\_\_\_ and the supply curve will be (horizontal, vertical) \_\_\_\_\_. Typically, in the short run the price elasticity of supply is (more, less) \_\_\_\_\_ elastic but in the long run the price elasticity of supply is \_\_\_\_\_ elastic.
12. There is a total-revenue test for the elasticity of (demand, supply) \_\_\_\_\_. There is no total-revenue test for the elasticity of (demand, supply) \_\_\_\_\_ because regardless of the degree of elasticity, price and total revenue are (directly, indirectly) \_\_\_\_\_ related.
13. The measure of the sensitivity of the consumption of one product given a change in the price of another product is the (cross, income) \_\_\_\_\_ elasticity of demand, while the measure of the responsiveness of consumer purchases to changes in income is the \_\_\_\_\_ elasticity of demand.
14. When the cross elasticity of demand is positive, two products are (complements, substitutes, independent) \_\_\_\_\_, but when the cross elasticity of demand is negative, they are \_\_\_\_\_; a zero cross elasticity suggests that two products are \_\_\_\_\_.
15. If consumers increase purchases of a product as consumer incomes increase, then a good is classified as (inferior, normal or superior) \_\_\_\_\_, but if consumers decrease purchases of a product as consumer incomes increase, then a good is classified as \_\_\_\_\_.
16. A consumer surplus is the difference between the actual price and the (minimum, maximum) \_\_\_\_\_ price a consumer is (or consumers are) willing to pay for a product. In most markets, consumers individually or collectively gain more total utility or satisfaction when the actual or equilibrium price they have to pay for a product is (less, more) \_\_\_\_\_ than what they would have been willing to pay to obtain the product. Consumer surplus and price are (positively, negatively) \_\_\_\_\_ related. This means that higher prices (increase, decrease) \_\_\_\_\_ consumer surplus and lower prices \_\_\_\_\_ it.
17. A producer surplus is the difference between the actual or equilibrium price and the (minimum, maximum) \_\_\_\_\_ acceptable price a producer is (or producers are) willing to accept in exchange for a product. In most markets, sellers individually or collectively benefit when they sell their product at an actual or equilibrium price that is (less, more) \_\_\_\_\_ than what they would have been willing to receive in exchange for the product. Producer surplus and price are (positively, negatively) \_\_\_\_\_ related. This means that higher prices (increase, decrease) \_\_\_\_\_ producer surplus and lower prices \_\_\_\_\_ it.
18. When competition forces producers to use the best techniques and combinations of resources to make a product, then (allocative, productive) \_\_\_\_\_ efficiency is being achieved. When the correct or optimal quantity of output of a product is being produced relative to the other goods and services, then \_\_\_\_\_ efficiency is being achieved.
19. Allocative efficiency occurs at quantity levels where marginal benefit is (greater than, less than, equal to) \_\_\_\_\_ marginal cost, maximum willingness to pay by consumers is \_\_\_\_\_ the minimum acceptable price for producers, and the combined consumer and producer surplus is at a (minimum, maximum) \_\_\_\_\_.
20. When there is overproduction of a product, there are efficiency (gains, losses) \_\_\_\_\_ and when there is underproduction there are efficiency \_\_\_\_\_. In both cases, the combined consumer and producer surplus is (greater than, less than) \_\_\_\_\_ the maximum that would occur at the efficient quantity of output.

### ■ TRUE-FALSE QUESTIONS

Circle T if the statement is true, F if it is false.

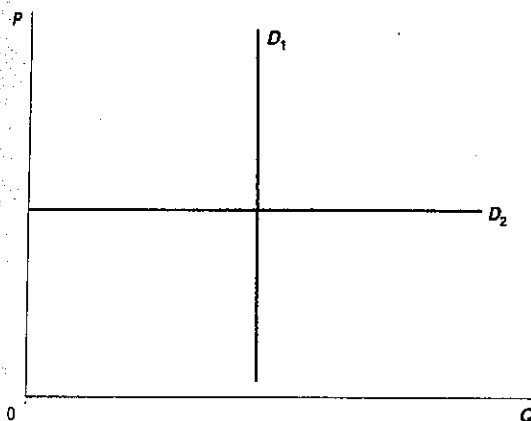
1. If the percentage change in price is greater than the percentage change in quantity demanded, the price elasticity coefficient is greater than 1. T F
2. If the quantity demanded for a product increases from 100 to 150 units when the price decreases from \$14 to \$10, using the midpoint formula, the price elasticity of demand for this product in this price range is 1.2. T F
3. A product with a price elasticity of demand equal to 1.5 is described as price inelastic. T F
4. If the price of a product increases from \$5 to \$6 and the quantity demanded decreases from 45 to 25, then according to the total-revenue test, the product is price inelastic in this price range. T F
5. Total revenue will not change when price changes if the price elasticity of demand is unitary. T F
6. When the absolute value of the price elasticity coefficient is greater than 1 and the price of the product decreases, then the total revenue will increase. T F
7. The flatness or steepness of a demand curve is based on absolute changes in price and quantity, while elasticity is based on relative or percentage changes in price and quantity. T F
8. Demand tends to be inelastic at higher prices and elastic at lower prices. T F
9. Price elasticity of demand and the slope of the demand curve are two different things. T F
10. In general, the larger the number of substitute goods that are available, the less the price elasticity of demand. T F
11. Other things equal, the higher the price of a good relative to consumers' incomes, the greater the price elasticity of demand. T F
12. Other things equal, the higher the price of a good relative to the longer the time period the purchase is considered, the greater the price elasticity of demand. T F
13. The more that a good is considered to be a "luxury" rather than a "necessity," the less is the price elasticity of demand. T F
14. The demand for most agricultural products is price inelastic. Consequently, an increase in supply will reduce the total income of producers of agricultural products. T F
15. A state government seeking to increase its excise-tax revenues is more likely to increase the tax rate on restaurant meals than on gasoline. T F
16. The degree of price elasticity of supply depends on how easily and quickly producers can shift resources between alternative uses. T F
17. If an increase in product price results in no change in the quantity supplied, supply is perfectly elastic. T F

18. The market period is a time so short that producers cannot respond to a change in demand and price. T F
19. The price elasticity of supply will tend to be more elastic in the long run. T F
20. There is a total revenue test for the elasticity of supply. T F
21. For a complementary good, the coefficient of the cross elasticity of demand is positive. T F
22. Cross elasticity of demand is measured by the percentage change in quantity demanded over the percentage change in income. T F
23. A negative cross elasticity of demand for two goods indicates that they are complements. T F
24. Inferior goods have a positive income elasticity of demand. T F
25. Consumer surplus is the difference between the minimum and maximum price a consumer is willing to pay for a good. T F
26. Consumer surplus is a utility surplus that reflects a gain in total utility or satisfaction. T F
27. Consumer surplus and price are directly or positively related. T F
28. Producer surplus is the difference between the actual price a producer receives for a product and the minimum price the producer would have been willing to accept for the product. T F
29. The higher the actual price, the less the amount of producer surplus. T F
30. Efficiency losses are increases in the combined consumer and producer surplus. T F

### ■ MULTIPLE-CHOICE QUESTIONS

Circle the letter that corresponds to the best answer.

1. If, when the price of a product rises from \$1.50 to \$2, the quantity demanded of the product decreases from 1000 to 900, the price elasticity of demand coefficient, using the midpoint formula, is
  - (a) 3.00
  - (b) 2.71
  - (c) 0.37
  - (d) 0.33
2. If a 1% fall in the price of a product causes the quantity demanded of the product to increase by 2%, demand is
  - (a) inelastic
  - (b) elastic
  - (c) unit elastic
  - (d) perfectly elastic
3. In the following diagram,  $D_1$  is a
  - (a) perfectly elastic demand curve
  - (b) perfectly inelastic demand curve
  - (c) unit elastic demand curve
  - (d) a long-run demand curve



4. Compared to the lower-right portion, the upper-left portion of most demand curves tends to be

- (a) more inelastic
- (b) more elastic
- (c) unit elastic
- (d) perfectly inelastic

5. In which range of the demand schedule is demand price inelastic?

Price	Quantity demanded
\$11	50
9	100
7	200
5	300
3	400

- (a) \$11–\$9
- (b) \$9–\$7
- (c) \$7–\$5
- (d) \$5–\$3

6. If a business increased the price of its product from \$7 to \$8 when the price elasticity of demand was inelastic, then

- (a) total revenues decreased
- (b) total revenues increased
- (c) total revenues remain unchanged
- (d) total revenues were perfectly inelastic

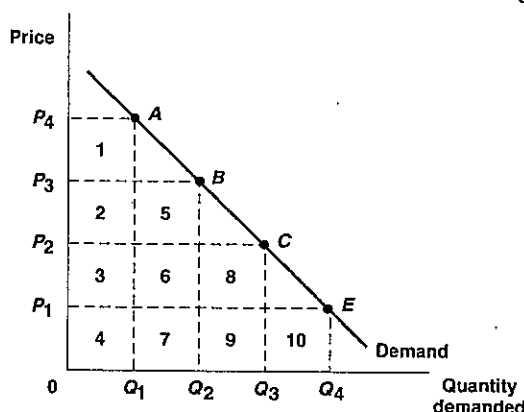
7. You are the sales manager for a pizza company and have been informed that the price elasticity of demand for your most popular pizza is greater than 1. To increase total revenues, you should

- (a) increase the price of the pizza
- (b) decrease the price of the pizza
- (c) hold pizza prices constant
- (d) decrease demand for your pizza

8. Assume Amanda Herman finds that her total spending on compact discs remains the same after the price of compact discs falls, other things equal. Which of the following is true about Amanda's demand for compact discs with this price change?

- (a) It is unit price elastic.
- (b) It is perfectly price elastic.
- (c) It is perfectly price inelastic.
- (d) It increased in response to the price change.

Questions 9, 10, and 11 are based on the following graph.



9. If price is  $P_3$ , then total revenue is measured by the area

- (a)  $OP_3CQ_3$
- (b)  $OP_3BQ_2$
- (c)  $OP_3BQ_3$
- (d)  $OP_3CQ_2$

10. If price falls from  $P_2$  to  $P_1$ , then in this price range demand is

- (a) relatively inelastic because the loss in total revenue (areas 3 + 6 + 8) is greater than the gain in total revenue (area 10)
- (b) relatively elastic because the loss in total revenue (areas 3 + 6 + 8) is greater than the gain in total revenue (area 10)
- (c) relatively inelastic because the loss in total revenue (area 10) is less than the gain in total revenue (areas 3 + 6 + 8)
- (d) relatively inelastic because the loss in total revenue (areas 4 + 7 + 9 + 10) is greater than the gain in total revenue (areas 3 + 6 + 8)

11. As price falls from  $P_4$  to  $P_3$ , you know that demand is

- (a) elastic because total revenue decreased from  $OP_4AQ_1$  to  $OP_3BQ_2$
- (b) inelastic because total revenue decreased from  $OP_3BQ_2$  to  $OP_4AQ_1$
- (c) elastic because total revenue increased from  $OP_4AQ_1$  to  $OP_3BQ_2$
- (d) inelastic because total revenue decreased from  $OP_4AQ_1$  to  $OP_3BQ_2$

12. Which is characteristic of a product whose demand is elastic?

- (a) The price elasticity coefficient is less than 1.
- (b) Total revenue decreases if price decreases.
- (c) Buyers are relatively insensitive to price changes.
- (d) The percentage change in quantity is greater than the percentage change in price.

13. The demand for Nike basketball shoes is more price elastic than the demand for basketball shoes as a whole. This is best explained by the fact that

- (a) Nike basketball shoes are a luxury good, not a necessity
- (b) Nike basketball shoes are the best made and widely advertised

- (c) there are more complements for Nike basketball shoes than for basketball shoes as a whole  
 (d) there are more substitutes for Nike basketball shoes than for basketball shoes as a whole

14. Which is characteristic of a good whose demand is inelastic?

- (a) There are a large number of good substitutes for the good for consumers.  
 (b) The buyer spends a small percentage of total income on the good.  
 (c) The good is regarded by consumers as a luxury.  
 (d) The period of time for which demand is given is relatively long.

15. From a time perspective, the demand for most products is

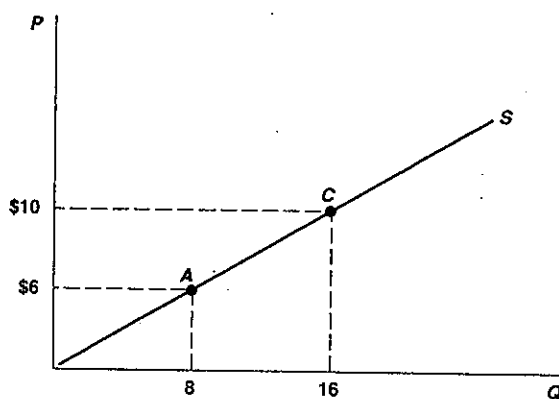
- (a) less elastic in the short run and unit elastic in the long run  
 (b) less elastic in the long run and unit elastic in the short run  
 (c) more elastic in the short run than in the long run  
 (d) more elastic in the long run than in the short run

16. If a 5% fall in the price of a commodity causes quantity supplied to decrease by 8%, supply is

- (a) inelastic  
 (b) unit elastic  
 (c) elastic  
 (d) perfectly inelastic

17. In the following diagram, what is the price elasticity of supply between points A and C (using the midpoint formula)?

- (a) 1.33  
 (b) 1.67  
 (c) 1.85  
 (d) 2.46



18. If supply is inelastic and demand decreases, the total revenue of sellers will

- (a) increase  
 (b) decrease  
 (c) decrease only if demand is elastic  
 (d) increase only if demand is inelastic

19. The chief determinant of the price elasticity of supply of a product is

- (a) the number of good substitutes the product has  
 (b) the length of time sellers have to adjust to a change in price

- (c) whether the product is a luxury or a necessity  
 (d) whether the product is a durable or a nondurable good

20. A study shows that the coefficient of the cross elasticity of Coke and Sprite is negative. This information indicates that Coke and Sprite are

- (a) normal goods  
 (b) complementary goods  
 (c) substitute goods  
 (d) independent goods

21. If a 5% increase in the price of one good results in a decrease of 2% in the quantity demanded of another good, then it can be concluded that the two goods are

- (a) complements  
 (b) substitutes  
 (c) independent  
 (d) normal

22. Most goods can be classified as *normal* goods rather than inferior goods. The definition of a normal good means that

- (a) the percentage change in consumer income is greater than the percentage change in price of the normal good  
 (b) the percentage change in quantity demanded of the normal good is greater than the percentage change in consumer income  
 (c) as consumer income increases, consumer purchases of a normal good increase  
 (d) the income elasticity of demand is negative

23. Based on the information in the table, which product would be an inferior good?

Product	% change in income	% change in quantity demanded
A	-10	+10
B	+10	+10
C	+5	-5
D	-5	-5

- (a) Product A  
 (b) Product B  
 (c) Product C  
 (d) Product D

24. For which product is the income elasticity of demand most likely to be negative?

- (a) automobiles  
 (b) bus tickets  
 (c) computers  
 (d) tennis rackets

25. Katie is willing to pay \$50 for a product and Tom is willing to pay \$40. The actual price that they have to pay is \$30. What is the amount of the consumer surplus for Katie and Tom combined?

- (a) \$30  
 (b) \$40  
 (c) \$50  
 (d) \$60



26. Given the demand curve, the consumer surplus is
- increased by higher prices and decreased by lower prices
  - decreased by higher prices and increased by lower prices
  - increased by higher prices but not affected by lower prices
  - decreased by lower prices, but not affected by higher prices

27. The difference between the actual price that a producer receives (or producers receive) and the minimum acceptable price is producer

- cost
- wealth
- surplus
- investment

28. The minimum acceptable price for a product that Juan is willing to receive is \$20. It is \$15 for Carlos. The actual price they receive is \$25. What is the amount of the producer surplus for Juan and Carlos combined?

- \$10
- \$15
- \$20
- \$25

29. When the combined consumer and producer surplus is at a maximum for a product,

- the quantity supplied is greater than the quantity demanded
- the market finds alternative ways to ration the product
- the market is allocatively efficient
- the product is a nonpriced good

30. When the output is greater than the optimal level of output for a product there are efficiency

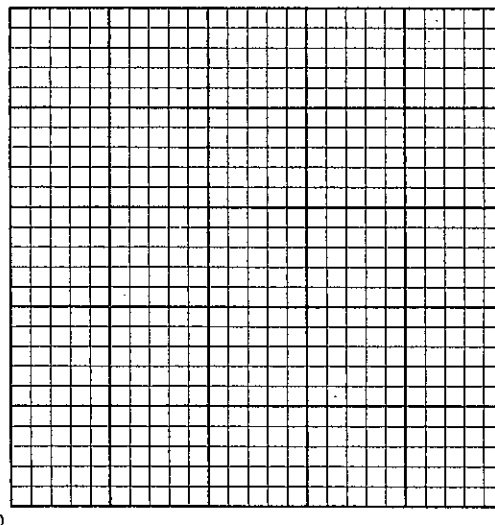
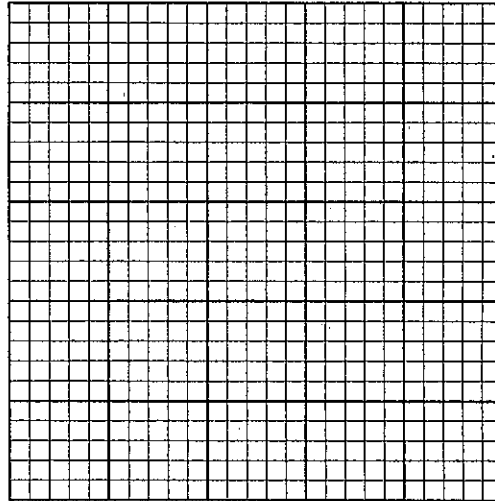
- gains from the underproduction of the product
- losses from the underproduction of the product
- gains from the overproduction of the product
- losses from the overproduction of the product

### ■ PROBLEMS

1. Complete the following table, using the demand data given, by computing total revenue at each of the seven prices and the six price elasticity coefficients between each of the seven prices, and indicate whether demand is elastic, inelastic, or unit elastic between each of the seven prices.

Price	Quantity demanded	Total revenue	Elasticity coefficient	Character of demand
\$1.00	300	_____		
.90	400	_____	_____	_____
.80	500	_____	_____	_____
.70	600	_____	_____	_____
.60	700	_____	_____	_____
.50	800	_____	_____	_____
.40	900	_____	_____	_____

2. Use the data from the table for this problem. On the *first* of the two following graphs, plot the demand curve (price and quantity demanded) and indicate the elastic, inelastic, and unit elastic portions of the demand curve. On the *second* graph, plot the total revenue on the vertical axis and the quantity demanded on the horizontal axis. (Note: The scale for quantity demanded that you plot on the horizontal axis of each graph should be the same.)



- a. As price decreases from \$1.00 to \$0.70, demand is (elastic, inelastic, unit elastic) \_\_\_\_\_ and total revenue (increases, decreases, remains the same) \_\_\_\_\_.

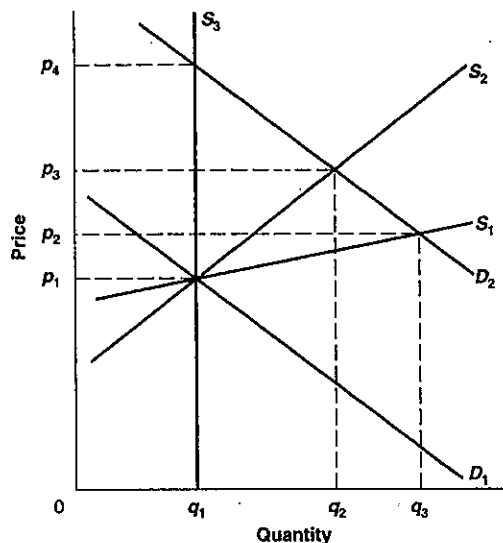
- b. As price decreases from \$0.70 to \$0.60, demand is (elastic, inelastic, unit elastic) \_\_\_\_\_ and total revenue (increases, decreases, remains the same) \_\_\_\_\_.

c. As price decreases from \$0.60 to \$0.40, demand is (elastic, inelastic, unit elastic) \_\_\_\_\_ and total revenue (increases, decreases, remains the same) \_\_\_\_\_.

3. Using the supply data in the following schedule, complete the table by computing the six price elasticity of supply coefficients between each of the seven prices, and indicate whether supply is elastic, inelastic, or unit elastic.

Price	Quantity coefficient	Elasticity demanded	Character of supply
\$1.00	800		
.90	700		
.80	600		
.70	500		
.60	400		
.50	300		
.40	200		

4. The following graph shows three different supply curves ( $S_1$ ,  $S_2$ , and  $S_3$ ) for a product bought and sold in a competitive market.



- a. The supply curve for the
- (1) market period is the one labeled \_\_\_\_\_.
  - (2) short run is the one labeled \_\_\_\_\_.
  - (3) long run is the one labeled \_\_\_\_\_.
- b. No matter what the period of time under consideration, if the demand for the product were  $D_1$ , the equilibrium price of the product would be \_\_\_\_\_ and the equilibrium quantity would be \_\_\_\_\_.  
 (1) If demand were to increase to  $D_2$  in the market period the equilibrium price would increase to \_\_\_\_\_ and the equilibrium quantity would be \_\_\_\_\_.

- (2) In the short run the price of the product would increase to \_\_\_\_\_ and the quantity would increase to \_\_\_\_\_.
- (3) In the long run the price of the product would be \_\_\_\_\_ and the quantity would be \_\_\_\_\_.

c. The longer the period of time allowed to sellers to adjust their outputs the (more, less) \_\_\_\_\_ elastic is the supply of the product.  
 d. The more elastic the supply of a product, the (greater, less) \_\_\_\_\_ the effect on equilibrium price and the \_\_\_\_\_ the effect on equilibrium quantity of an increase in demand.

5. For the following three cases, use a midpoint formula to calculate the coefficient for the cross elasticity of demand and identify the relationship between the two goods (complement, substitute, or independent).

a. The quantity demanded for good A increases from 300 to 400 as the price of good B increases from \$1 to \$2.

Coefficient: \_\_\_\_\_ Relationship: \_\_\_\_\_

b. The quantity demanded for good J decreases from 2000 to 1500 as the price of good K increases from \$10 to \$15.

Coefficient: \_\_\_\_\_ Relationship: \_\_\_\_\_

c. The quantity demanded for good X increases from 100 to 101 units as the price of good Y increases from \$8 to \$15.

Coefficient: \_\_\_\_\_ Relationship: \_\_\_\_\_

6. Use the information in the following table to identify the income characteristic of each product A–E using the following labels: N = normal (or superior), I = inferior.

Product	% change in income	% change in quantity demanded	Income type (N or I)
A	10	10	
B	1	15	
C	5	-12	
D	5	-2	
E	10	1	

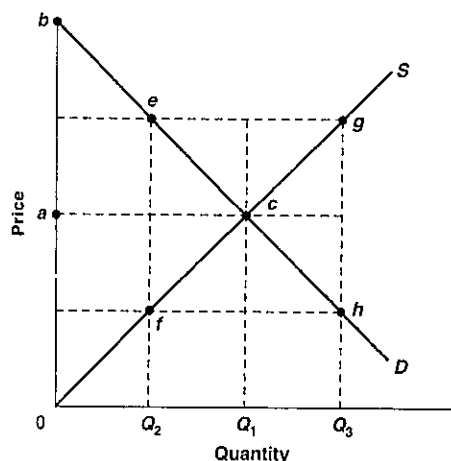
7. Given the following information, calculate the consumer surplus for each individual A to F.

(1) Person	(2) Maximum price willing to pay	(3) Actual price (equilibrium price)	(4) Consumer surplus
A	\$25	\$12	
B	23	12	
C	18	12	
D	16	12	
E	13	12	
F	12	12	

8. Given the following information, calculate the producer surplus for each producer A to F.

(1) Producers	(2) Minimum Acceptable Price	(3) Actual price (equilibrium price)	(4) Producer surplus
A	\$4	\$12	_____
B	5	12	_____
C	7	12	_____
D	9	12	_____
E	10	12	_____
F	12	12	_____

9. Answer this question based on the following graph showing the market supply and demand for a product. Assume that the output level is  $Q_1$ .



- The area of consumer surplus would be shown by the area \_\_\_\_\_.
- The area of producer surplus would be shown by the area \_\_\_\_\_.
- The area that maximizes the combined consumer and producer surplus is \_\_\_\_\_.
- If the output level is now  $Q_2$ , then there are efficiency losses shown by area \_\_\_\_\_.
- If the output level is now  $Q_3$ , then there are efficiency losses shown by area \_\_\_\_\_.

#### ■ SHORT ANSWER AND ESSAY QUESTIONS

1. Define and explain the price elasticity of demand in terms of the relationship between the relative (percentage) change in quantity demanded and the relative (percentage) change in price. Use the elasticity coefficient in your explanation.

2. What is meant by perfectly elastic demand? By perfectly inelastic demand? What does the demand curve look like when demand is perfectly elastic and when it is perfectly inelastic?

3. Demand seldom has the same elasticity at all prices. What is the relationship between the price of most products and the price elasticity of demand for them?

4. What is the relationship—if there is one—between the price elasticity of demand and the slope of the demand curve?

5. When the price of a product declines, the quantity demanded of it increases. When demand is elastic, total revenue is greater at the lower price, but when demand is inelastic, total revenue is smaller. Explain why total revenue will sometimes increase and why it will sometimes decrease.

6. Explain the effect of the number of substitutes on the price elasticity of demand.

7. Why does the price elasticity of demand differ based on the price of a good as a proportion of household income? Give examples.

8. Is the quantity demanded for necessities more or less responsive to a change in price? Explain using examples.

9. What role does time play in affecting the elasticity of demand?

10. How do opponents of the decriminalization of illegal drugs use elasticity to make their arguments?

11. Explain what determines the price elasticity of supply of an economic good or service.

12. Why is there no total revenue test for the elasticity of supply?

13. Discuss the supply and demand conditions for antiques. Why are antique prices so high?

14. Use the concepts of the elasticity of supply to explain the volatility of gold prices.

15. How can goods be classified as complementary, substitute, or independent? On what basis is this judgment made?

16. Give definitions of a normal good and an inferior good. Illustrate each definition with an example.

17. What are two examples of insights that income elasticity of demand coefficients provide about the economy?

18. How is the consumer surplus related to utility or satisfaction? Explain, using a supply and demand graph.

19. Define, using a supply and demand graph, the meaning of producer surplus.

20. Use consumer and producer surplus to describe efficiency losses in a competitive market. Provide a supply and demand graph to show such losses.

## ANSWERS

### Chapter 6 Elasticity, Consumer Surplus, and Producer Surplus

#### FILL-IN QUESTIONS

1. inelastic, elastic
2. average, average
3. percentages, responsiveness
4. inelastic, vertical, elastic, horizontal
5. varies, an unsound
6. a. greater; b. less; c. is equal to
7. Elastic: greater than 1, decrease, increase; Inelastic: less than 1, increase, decrease; Unit elastic: equal to 1, remain constant, remain constant
8. a. The number of good substitute products; b. The relative importance of the product in the total budget of the buyer; c. Whether the good is a necessity or a luxury; d. The period of time in which demand is being considered (any order a-d)
9. inelastic, decrease, inelastic, increase
10. quantity supplied, price, time, more
11. inelastic, vertical, less, more
12. demand, supply, directly
13. cross, income
14. substitutes, complements, independent
15. normal or superior, inferior
16. maximum, less, negatively, decrease, increase
17. minimum, more, positively, increase, decrease
18. productive, allocative
19. equal to, equal to, maximum
20. losses, losses, less than

#### TRUE-FALSE QUESTIONS

- |                        |                    |                    |
|------------------------|--------------------|--------------------|
| 1. F, p. 114           | 11. T, p. 120      | 22. F, pp. 124-125 |
| 2. T, p. 114           | 12. T, p. 120      | 23. T, p. 125      |
| 3. F, p. 115           | 13. F, p. 120      | 24. F, p. 125      |
| 4. F, pp. 116-118      | 14. T, p. 121      | 25. F, pp. 126-127 |
| 5. F, p. 118           | 15. F, p. 121      | 26. T, pp. 126-127 |
| 6. T, pp. 116-118, 120 | 16. T, p. 122      | 27. F, pp. 126-127 |
| 7. F, pp. 118-119      | 17. F, p. 122      | 28. T, pp. 127-128 |
| 8. T, pp. 120-121      | 18. T, pp. 122-123 | 29. F, pp. 127-128 |
| 9. T, pp. 120-122      | 19. T, pp. 123-124 | 30. F, p. 129      |
| 10. F, p. 120          | 20. F, p. 124      |                    |
|                        | 21. F, pp. 124-125 |                    |

#### MULTIPLE-CHOICE QUESTIONS

- |                    |                    |                    |
|--------------------|--------------------|--------------------|
| 1. c, p. 114       | 11. c, pp. 116-118 | 21. a, p. 125      |
| 2. b, p. 115       | 12. d, pp. 117-118 | 22. c, p. 125      |
| 3. b, pp. 115-116  | 13. d, p. 120      | 23. a, p. 125      |
| 4. b, pp. 118-119  | 14. b, p. 120      | 24. b, p. 125      |
| 5. d, pp. 118-119  | 15. d, p. 120      | 25. a, pp. 126-127 |
| 6. b, pp. 119-120  | 16. c, p. 122      | 26. b, pp. 126-127 |
| 7. b, pp. 119-120  | 17. a, p. 122      | 27. c, pp. 127-128 |
| 8. a, pp. 116-118  | 18. b, p. 122      | 28. b, pp. 127-128 |
| 9. b, p. 117       | 19. b, pp. 122-123 | 29. c, pp. 128-129 |
| 10. a, pp. 116-118 | 20. b, p. 125      | 30. d, p. 129      |

#### PROBLEMS

1. Total revenue: \$300, 360, 400, 420, 420, 400, 360; Elasticity coefficient: 2.71, 1.89, 1.36, 1, 0.73, 0.53; Character of demand: elastic, elastic, elastic, unit elastic, inelastic, inelastic
2. a. elastic, increases; b. unit elastic, remains the same; c. inelastic, decreases
3. Elasticity coefficient: 1.27, 1.31, 1.36, 1.44, 1.57, 1.8; Character of supply: elastic, elastic, elastic, elastic, elastic, elastic
4. a. (1)  $S_3$ ; (2)  $S_2$ ; (3)  $S_1$ ; b.  $p_1$ ,  $q_1$ , (1)  $p_4$ ,  $q_1$ ; (2)  $p_3$ ,  $q_2$ ; (3)  $p_2$ ,  $q_3$ ; c. more; d. less, greater
5. a. .43, substitute; b. -.71, complement; c. .02, independent
6. N, N, I, I, N
7. 13, 11, 6, 4, 1, 0
8. 8, 7, 5, 3, 2, 0
9. a. abc; b. Oac; c. Obc; d. efc; e. ghc

#### SHORT ANSWER AND ESSAY QUESTIONS

- |                |                 |                 |
|----------------|-----------------|-----------------|
| 1. pp. 114-115 | 8. p. 120       | 15. p. 125      |
| 2. pp. 115-116 | 9. p. 120       | 16. p. 125      |
| 3. pp. 118-119 | 10. pp. 121-122 | 17. pp. 125-126 |
| 4. pp. 118-119 | 11. p. 122      | 18. pp. 126-127 |
| 5. pp. 116-118 | 12. p. 124      | 19. pp. 127-128 |
| 6. p. 120      | 13. p. 124      | 20. p. 129      |
| 7. p. 120      | 14. p. 124      |                 |